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Malherbe

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[54] **CARBURETOR**

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[30] **Foreign Application Priority Data**

Jan. 27, 1972 France 72.2727

[52] **U.S. Cl.** ..... **123/119 A,** 123/122 A, 123/97 B, 123/141, 261/DIG. 55, 261/79 R, 261/DIG. 19, 261/145, 261/142

[51] **Int. Cl.** **F02b 25/06**

[58] **Field of Search** ..... 123/97 B, 122 AA, 141, 123/119 A; 261/DIG. 55, 79 R

[56] **References Cited**

UNITED STATES PATENTS

1,392,473	10/1921	Ball	261/DIG. 55
2,886,020	5/1959	Wolfe	123/97 B
2,977,205	3/1961	Austin	123/141
3,053,242	9/1962	Arpaia	123/122 AA
3,077,391	2/1963	Guffra	123/141
3,085,869	4/1963	Benes	123/141
3,371,914	5/1968	Walker	123/97 B
3,395,899	8/1968	Kopa	261/79 R
3,437,467	4/1969	Jacobus	123/141
3,544,290	12/1970	Larson	123/141
3,661,367	5/1972	Mennesson	123/97 B
3,677,526	7/1972	Pieriot	123/97 B

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[57] **ABSTRACT**

A carburetor for providing a fuel-air mixture to an internal combustion engine in such a manner as to minimize pollution by the engine.

17 Claims, 5 Drawing Figures

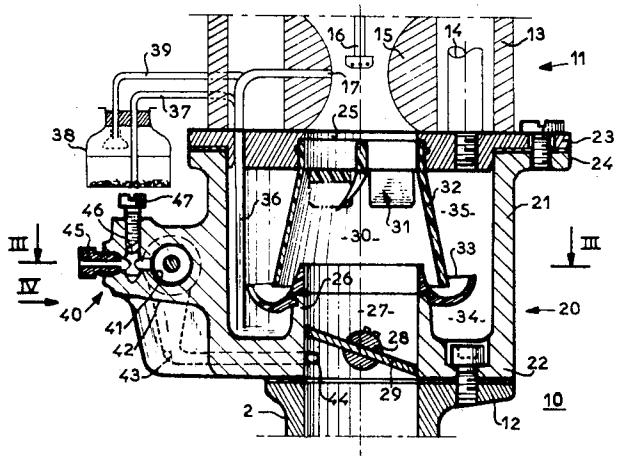

Fig: 1.

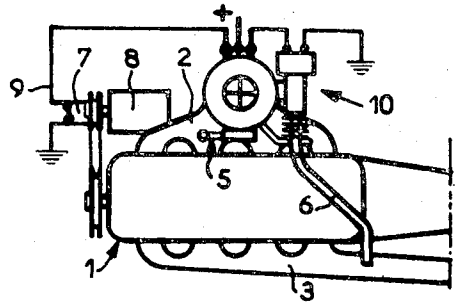

Fig: 3.

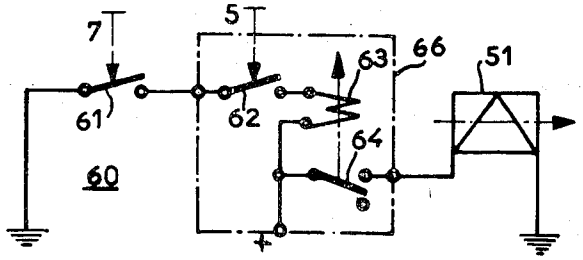

Fig: 4.

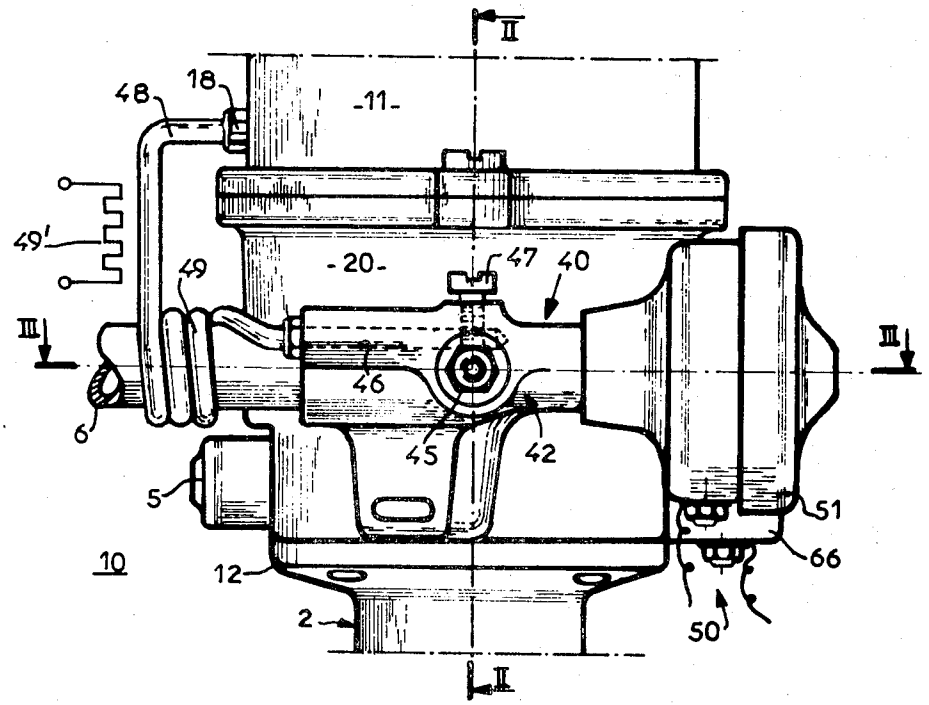

Fig: 2.

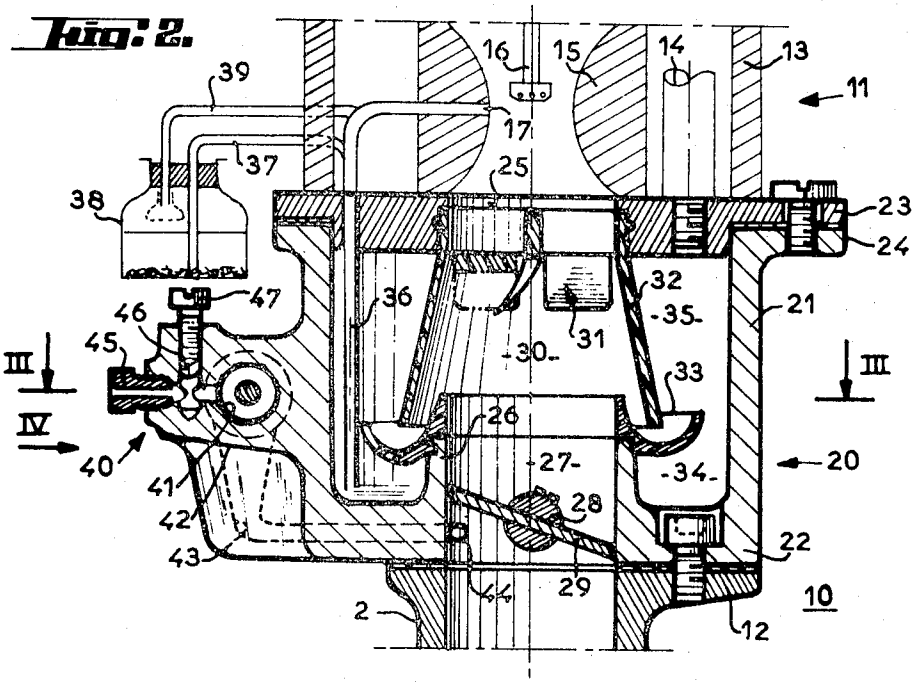
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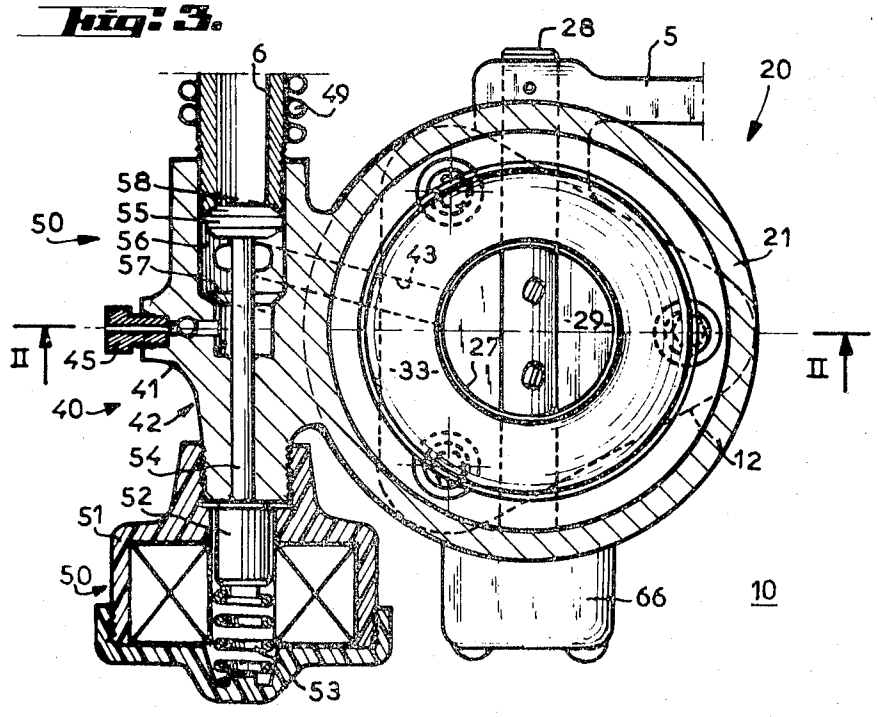
Fig: 3.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CARBURETOR

BACKGROUND OF THE INVENTION

The general idea of this invention is to supply a combustible mixture to internal combustion engines, particularly automobile engines, which should, from now on, comply with the strict standards of the anti-pollution laws. Fuel supply to internal combusition engines is normally carried out by one or more carburetors or by a direct or indirect injection device whose purpose is to mix fuel with the intake air in proper proportion for operations of the engine. An ideal mixture for all engines can be realized only by employing complex mechanisms which, as a consequence, are costly, require delicate adjustment and are prone to go out of adjustment with normal usage. From a practical standpoint, then, the fuel mixture is rarely optimum for the operation of the engine, thus the exhaust gasses contain pollutants, which are not insignificant and therefore important, such as oxides of carbon, various oxides of nitrogen, unburned hydrocarbon, also tetraethyl of lead and other additives which are incorporated in the fuel but do not burn. In other words, to reduce the ill-fated consequences of this emission of pollutants, strict regulations have been recently introduced with which all future automobiles will have to comply. Now, very few of the anti-pollution systems yet devised meet the requirements of the new regulations, and the rare few that do, have the common drawbacks of being costly to make and use, and they appreciably effect performance or fuel consumption. Therefore, the object of this invention is a method and application for supplying (fuel) to an internal combustion engine which is not only easily and inexpensively accomplished, but in addition meets the various existing or future regulations as numerous official tests have proven. This invention provides the following fundamental functions: Furnish the engine, while cruising or accelerating, with a dry, automatically, proportioned combustible mixture by centrifugal action as a result of its speed, with recovery and eventual recycling of excess fuel and elimination of entrapped impurities. With the engine throttled down, furnish the engine with only a separately prepared combustible gas mixture brought about by mixing the fuel in fixed proportions in a small flow of primary air, then heating of the mixture, for example, by the exhaust gasses, and finally admission of a prescribed flow of secondary air. During deceleration, to cut off all supply of combustible mixture to the engine so, therefore, the intake is connected to the exhaust.

In corollary manner, this invention includes fundamentally and in combination: A principal device, to supply the engine while cruising and accelerating which is located downstream of the conventional means (carburetor) of atomizing fuel in the intake air stream and which will have static elements to dry the mixture by centrifugal action resulting from its rapid outflow, and also succeeding means of collecting and eventually recycling excess fuel and eliminating entrapped impurities. An auxiliary device whose purpose is to supply the engine, when throttled back, which has, besides the conventional means for mixing fuel in prescribed proportions with a small flow of primary air, means for heating the mixture, for example by exhaust gasses, and means for adding to the mixture, thus heated a metered flow of fresh secondary air. A control device consisting

first of an accelerating butterfly (valve) capable of tightly shutting off flow between the principal device and the intake to the engine, and, secondly, an automatic three-way valve by which a discharge path downstream of the aforementioned butterfly is selectively connected to the auxiliary device, or if the butterfly is closed because the engine speed is greater than a selected limit, with the engine exhaust.

Another feature of the invention, the principal device consists essentially of a tubular container provided with an inlet connection located over an outlet connection, arranged coaxially and essentially of the same diameter, in which the following elements are located in the mainstream of the mixture flow:

A system of elastically flexible blade which imparts a helical flow to the aforementioned mixture where the pitch of said helical flow varies as a function of the velocity of the mixture.

A conical skirt by which the heavy particles of the mixture are separated by centrifugal action and

An annular trough, which forms a collector, and is located below the lower unattached end of the aforementioned skirt, whose inner rim is attached to the outlet connection.

It can be shown from the foregoing features, that the invention will supply the engine, under all operating conditions, a combustible mixture wherein the proportion of fuel will be optimum, because whether cruising or accelerating, the mixture is automatically proportioned by the same factor, its velocity, which reflects exactly the requirements of the engine, while when idling the engine receives a perfectly dry mixture proportioned once and for all (the inference here is that the proportioning is in fixed ratio). Otherwise, during periods of deceleration, which generally result in the consumption of unburned fuel, when, in turn, increases the emission of pollutants, the supply to the engine is completely cut off without affecting the necessary braking action which is assured by the partial recycling of the exhaust gasses.

In total, the invention not only reduces considerably the emission of the pollutants under all operating requirements of the engine, but again appreciably reduces fuel consumption.

BRIEF DESCRIPTION OF THE DRAWINGS

The character of the invention, however, may be best understood by reference to one of its structural forms, as illustrated by the accompanying drawings, in which:

FIG. **1** is a schematic top view of an internal combustion engine equipped with anti-pollution device such as this invention,

FIGS. **2, 3** and **4,** show respectively, a cross section parallel to the main axis, a cross section perpendicular to the axis, and an exterior right hand side view of FIG. **1,** and

FIG. **5** shows an electrical schematic drawing of the control circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** is a top view of a schematic representation of an internal combustion engine, **1,** where the intake manifold and the exhaust manifold are respectively shown as **2,** and **3.** This invention is shown, in essence, as item **10,** mounted directly on the intake flange of the

intake manifold **2**, provided with an acceleration control **5**, and connected in one place to the exhaust manifold **3** by a reclaiming tube **6**, and in another place by a speed sensitive contact (electrical) **7** mounted on the end of the generator or alternator shaft **8** by wire **9**, with other electric connections with ground (electrical) and positive polarity indicated by appropriate symbols.

Item **10** is shown in detail by the cross sections and side views of FIGS. **2**, **3** and **4**. This item has the overall shape of a short flanged chamber **20** placed between the conventional simplified carburetor **11** and the intake flange **12** of the intake manifold. This chamber is made up of a cylindrical wall **21** closed at one end by the bottom **22** and attached to flange **12** with a gasket in between and closed at the other end by a removable cover **23**, with gasket, fastened to the flange **24** which forms the end of wall **21**. The body **13** of carburetor **11** is fastened to cover **23** by dowels **14**. The carburetor venturi **15**, furnished with the usual atomizing nozzle **16** discharges into an inlet port **25** located coaxially and passing through cover **23**. The bottom **22** of the chamber **20** forms into an inner annular wall **26** making an outlet port **27**, located coaxially with the inlet port **25** and of essentially same diameter. A butterfly (valve) shaft **28**, to which is attached a butterfly valve **29**, is located diametrically across the outlet port **27**, and is rotated by an accelerator control **5** and is capable of completely closing off the aforementioned port **27**.

Essential parts of the principal element of this supply device, which are part of the invention, are located inside the chamber **20** and serve to correct the proportioning and clean the combustible mixture coming from the carburetor when the engine is cruising or accelerating. This device is made up essentially of static elements **30**, made up in one part, of a system of elastically flexible blades **31** mounted in the inlet passage **25** integral with a conical skirt **32**, and in another part, of an annular trough **33** mounted on a rabbet **26** at the inner end of the outlet passage located under the free end of skirt **32**, these various elements being made adantageously of plastic materials.

Going further into detail, the blade system **31** is made up of four radial blades with their leading surfaces fixed in the axial direction and intergral with the upper end of skirt **32** and a central hub, and with their trailing surfaces curved to a particular shape. The individual blades **31** of the system are curved identically and in a manner so as to impart a helical flow to the combustible mixture passing through the inlet **25**.

It is one of the essential embodiments of the invention that the free curved ends of the blade system **31** are elastically flexible and tend to diminish their effectiveness (by changing shape) as the velocity of the combustible mixture increases. It follows that the mixture is subjected to a centrifugal action wherein the force (centrifugal) decreases with speed in accordance with the influence of the blades determined by their shape and flexibility, which, at the highest speed, are practically straightened out. For example, used "like a flag in a high wind" and to have practically no effect on the flow of the mixture. Because of this centrifugal action, the denser particles in the combustible mixture, such as dust, and other suspended impurities, and globules of unvaporized fuel are thrown against the skirt **32** and drip down the wall of the skirt eventually falling into the gutter **33** which serves as a collector. The rim of the gutter is gradually sloped and the heavy particles which have been collected fall into the annular depression **34** formed by the end **22** of the chamber **21** which serves as a temporary storage area. In effect, the annular space surrounding the skirt **32** forms a low pressure, slow-down chamber, which prevents the induction into the engine of the heavy particles in the combustible mixture which have been collected in the reservoir **34**.

These heavy particles can be retrieved and recycled in several ways: thus the reservoir **34** can be directly connected to an orifice **17** located in the throat of the venturi **15** by means of a siphon tube **36**, which brings about an almost instantaneous recycling of the collected fuel. In this way the same torque can be obtained with less pressure on the accelerator, which results in fuel economy without sacrifice in performance. Recycling of the collected fuel can just as well be deferred, in which case the reservoir **34** is connected by a siphon tube **37** which terminates at the bottom of a closed receptacle **38** in which the upper space is connected to the orifice of **37** by an intake tube **39** which is capped with a filter or strainer. The fuel collected in the receptacle **38** can be reused directly by the carburetor **11** as soon as its level reaches the inlet of the intake tube **39**. Preferably, this fuel is always returned to the reservoir after being filtered which prevents faulting of the carburetor. When the engine is throttled down, the accelerator pedal, completely released, closes the discharge port **27** by means of the butterfly valve **29** so that the principal supply device is inoperative. In this condition, and in conjunction with another essential part of the invention, the combustible mixture supplied to the engine is processed by an auxiliary supply device **40** described in the following.

This auxiliary device consists of a chamber **41** in a horizontal protuberance **42** emerging from the wall of chamber **20**, normally connected by a passage **43** leading from an orifice **44** located in the discharge port **27** downstream of the closed butterfly **29**. In another way chamber **41** is connected on the one hand to atmosphere through secondary air nozzel **45** and on the other hand by a port **46** located in the horizontal protuberance **42** with the port partially closed off by a regulating screw **47**. The outlet end of port **46** is connected by tubing **48** to an inlet connection **18** which leads to the regular low speed nozzle in carburetor **11**. The length of this tubing **48** is heated, either by coiling it several times around tube **6**, which is connected to the exhaust manifold, or by an electric heating element represented symbolically by resistance **49'**.

The auxiliary supply device, constructed in this fashion, functions as follows. The low speed nozzle in carburetor **11**, is designed to handle a very rich mixture. This mixture is first heated by coil **49** or resistance **49'** to a temperature high enough to completely vaporize the fuel. The regulating screw **47** allows adjustment of the small flow of hot gaseous mixture, thus obtained, to which a supply of relatively important fresh secondary air is added by means of the nozzle **45** to provide a low speed intake mixture which is supplied to the engine through chamber **41**, passage **43**, and orifice **44** located under the closed butterfly **29**. Thus the engine receives a combustible mixture free from all liquid particles and will turn over smoothly and without emitting pollutants. Risk of condensed fuel in the intake is practically eliminated. When the engine is running at cruising

speed or accelerating, the idling mixture furnished by auxiliary device **40** is not cut off but merely reduced because of the relative decrease in vacuum in the intake manifold **2.** This is never a problem because the auxiliary supply device furnishes a limited supply of combustible mixture which is purely gaseous. On the contrary, and in accordance with another important feature of the invention, the supply of idling mixture is completely cut off during periods of abrupt deceleration, that is, when the butterfly **29** is closed and the engine is turning up at considerably faster than idle speed. This cut off of the combustible mixture to the engine during deceleration, very helpful in reducing the emission of pollutant, is brought about by an electromagnetic control device **50** which is described in the following. This device **50** consists essentially of an electromagnet **51** mounted at one end of protuberance **42** on the wall of chamber **20** and where the armature **52** held in one position by a return spring **53** is connected by a shaft **54** to a sliding valve **55** in a bore or cylinder **56** which is built in between chamber **41** and the tip of the exhaust gas return tube **6.** This bore **56** forms a valve chamber with a central port which is the end of passage **43** which terminates at the other end in orifice **44** and where the opposite ends of the valve chamber connect to chamber **41** and tube **6** by means of cut-off seats **57** and **58,** the latter formed by milling the end of tube **6.**

As shown in circuit diagram FIG. **5,** the electromagnet **51** can be energized by a control circuit **60** consisting of two open contacts **61** and **62** respectively actuated by the speed sensitive switch **7** and the accelerator control arm **5.** These contacts are in the series with relay coil **63** and form a circuit from the positive battery terminal to ground. Contact **64** is closed by energization of coil **63** and applies battery voltage to the electromagnet **51** from positive battery through **51** to ground. The speed sensitive device **7,** centrifugal type, for example, closes contact **61** when motor speed is above a preselected limit, higher than idle speed, for example, 1500 RPM. Accelerator control arm **5** closes contact **62** when the butterfly **29** of the principal supply device **20** is closed. Consequently, this contact is conveniently located near the end of the shaft **28** of butterfly **29,** under a box **66** in which relay **63-64** can also be enclosed. According to the previous description, device **50** is a **3** way electric valve by which the intake manifold **2** is selectively cut off from the auxiliary supply device **40** and connected to the exhaust gas sampling tube **6** when the engine is turning over fast enough and when the butterfly of the principal feed device is closed. By the combined action of the electrically operated valve and the butterfly, all fuel supply is cut off during deceleration which obviously eliminates all emission of pollutants but this does not impair the engine's braking ability because the exhaust is connected to the intake thereby providing the compression necessary for braking.

It should be understood the invention is not limited to the method of operation described and illustrated here which is simply one illustration. In fact this method of application could be modified and adapted with considerable latitude without departing from the frame work of the invention. More particularly, the three way valve could be controlled with electronic logic using other centrifugal sensors for speed signals possibly pneumatic or hydraulic. The combustimble mixtures could be handled by means other than a carburetor. The gathering up of exhaust gases could be done at the collector.

It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, however, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

The invention having thus been described, what is claimed as new and desired to secure by Letters Patent is:

1. Apparatus for supplying a combustion mixture to an internal combustion engine, particularly an automobile engine, subject to anti-pollution regulations comprising:

a. a principal device designed to supply the engine, while cruising and accelerating, which has located downstream of the conventional means of atomizing fuel in the intake air to the motor, static elements to dry the intake mixture by centrifugal action due to the velocity of flow, and subsequent means to collect and eventually recycle excess fuel and eliminate collected impurities,

b. an auxiliary device designed to supply the engine, when idling, which contains, in addition to the conventional means of proportioning a mixture of fuel with a small flow of primary air, means of heating the mixture, and of adding to the heated mixture a metered amount of fresh secondary air, and

c. a control device consisting, in one part of an accelerating butterfly capable of closing off the principal device from the intake to the engine and in another part of an automatic three way valve by which a passage discharging downstream of the aforementioned butterfly is selectively connected to the auxiliary device when the butterfly is not closed, and when the butterfly is closed, and the speed of the engine is above a predetermined limit, to the exhaust of said engine.

2. Apparatus as recited in claim **1,** wherein the conventional means of atomizing the fuel in the intake air which is associated with the principal device contains a nozzle located in the center of the venturi throat and usually supplied from constant level reservoir, and would resemble a simplified classic carburetor.

3. Apparatus as recited in claim **1,** wherein the principal device consists essentially of a tubular chamber with an upper entry port connection, and a lower exit port connection located coaxially and essentially of the same diameter and located in the center of the device and in which are located in the path of the incoming mixture:

a. a system of elastically flexible blades which impart a helical flow to the aforementioned mixture wherein the pitch of the helix varies directly as the speed,

b. a conical skirt by which heavy particles in the mixture are trapped by centrifugal action, and

c. an annular gutter which forms a collector and is located under the lower free end of the aforementioned skirt and in which the inner rims forms part of the exit port.

4. Apparatus as recited in claim **3** wherein the exit port is integral with the bottom of the chamber and forms a long interior wall which supports the gutter, so that the inlet is made up of a removable cover support-

ing the blade system, and the skirt, around which is formed a tranquilization chamber.

5. Apparatus as recited in claim 4 wherein the end of the chamber forms an annular reservoir in which the heavy particles in the mixture, collected in the gutter are received prior to being taken away.

6. Apparatus as recited in claim 4 wherein the butterfly is located in the exit port and its shaft is located along a diameter of the port.

7. Apparatus as recited in claim 1 wherein the chamber of the principal device is a short flanged cylinder mounted directly on the inlet flange of the intake manifold of the engine.

8. Apparatus as recited in claim 1 wherein the previously mentioned valve consists essentially of a cylindrical chamber in the horizontal wall in which is an orifice connected to a previously mentioned passage and wherein the extremities (of the valve chamber) form two cut-off seats, the first leading to the chamber receiving the gaseous mixture conditioned in the auxiliary device, and the second leading to a tube connected to the engine exhaust, one of the aforementioned seats being selectively blocked off by a piston which moves axially in the valve chamber.

9. Apparatus as recited in claim 8 wherein the previously cited piston is normally held against the second cut-off seat by a return spring, and is moved against the first cut-off seat only when the butterfly is closed and when the motor speed is above a preselected limit.

10. Apparatus as recited in claim 8 wherein the auxiliary device is integeral with the valve and consists essentially of a heating method, several coils of a prementioned tube, and connected to a discharge passage in the previously mentioned chamber and input nozzle for entry of secondary air which connects the chamber with the atomosphere.

11. Apparatus as recited in claim 10 wherein the previously mentioned passage can be partially closed off by a regulating means.

12. Apparatus as recited in claim 8 wherein the body of the previously mentioned valve is formed in the horizontal protuberance emenating from the chamber of the principal device.

13. Apparatus as recited in claim 1 wherein the previously mentioned valve is operated by an electromagnet energized by the simultaneous closing of a contact actuated by the butterfly and of a speed sensitive switch previously cited.

14. Apparatus as recited in claim 6 wherein the previously mentioned contact is mounted on the principal device, near the end of the butterfly valve shaft.

15. Apparatus as recited in claim 9 wherein the previously mentioned electro-magnet solenoid type, is mounted at the end of the valve body.

16. Apparatus as recited in claim 13 wherein the previously mentioned speed sensitive is of the centrifugal type and mounted on the end of the engine shaft, or on an auxiliary motor such as a generator or alternator.

17. Method of supplying an internal combustion engine, particularly an automobile engine, subject to the anti-pollution regulations, comprising the steps of,

a. while the automobile is cruising and accelerating, furnishing the engine with a dry combustible mixture, automatically proportioned, arrived at by atomizing the fuel in the air intake of the engine, and drying the mixture thus obtained by centrifugal action due to its speed, with reclamation and eventual recycling of excess fuel, and elimination of collected impurities,

b. while the engine is idling, furnishing only a combustible gaseous mixture, separately derived by mixing the fuel in predetermined proportions with a small flow of primary air, then heating the mixture, and finally introducing a metered flow of secondary air, and

c. while the automobile is decelerating cutting off the combustible mixture to the engine while the intake is by-passed to the exhaust.

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